formation is playful and jocose, such as a child would like to read, his puns are not good; nor are they such as his model, the late Charles Lamb, would care to have attached to his name. Speaking, for instance, of the Kangaroo, Mr. White says that the flying leaps of the great Boomer Kangaroo were found to measure 15 feet, "each hop being as regular as if the ground had been stepped over by a drill-sergeant. Charles Lamb," he adds, "would have called him a hopeful subject"! His language, too, in some places, is rather ambiguous. The notice of the Green Lizard, for instance, is very interesting—"a harmless and very pretty creature, which delights to bask in the sun, as if it wanted its cold blood warmed with the genial rays;" but we never knew before that this pretty little reptile could either admire, with a painter's eye, a beautiful landscape, or, like a skilful botanist or entomologist, collect plants or insects!—and yet our author says, "Jersey abounds in lizards; for I saw them nearly everywhere as I rested, *admiring the views, or picking up wild flowers and insects.*" Of course it was the author who did so; but, from the allocation of the words, and the punctuation, it appears as if it were the lizard that admired the prospect and picked up the wild plants.

In his preface, Mr. White gives us to understand that this volume is to be followed by another, containing "some of the more striking objects of Zoology." We shall be glad to see him again. From the title-page, it appears that this is the third edition of this work. It deserves such encouragement; for it is carefully got up, the descriptive letter-press contains much valuable information, which even *adults* may enjoy and be improved by, and the illustrations, which are generally upon a large scale, are sure to please the young, and give a good idea of the most striking characteristics of quadrupeds and the gay plumage of birds. At the end of the book there is appended a scientific index and a kind of tabular arrangement of great part of the animal kingdom. These must be very useful both to the general reader and to the teacher or parent who may use the book. To them and to all concerned in the education of young people, we strongly recommend this "Instructive Picture Book."

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

December 16, 1858.—Sir Benjamin C. Brodie, Bart., President, in the Chair.

"Description of a mutilated skull of a large Marsupial Carnivore (*Thylacoleo Carnifex*, Ow.), from a conglomerate stratum, eighty miles S.W. of Melbourne, Australia." By Professor R. Owen, F.R.S., &c.

In this paper the author gives a description of a fossil skull and certain of the teeth of a quadruped of the size of a lion, in which he points out the characters indicative of its carnivorous habits and of its affinities to the marsupial order.

The large size of the temporal fossæ, meeting to form a low crest on the parietal bone, and bounded behind by a strong occipital crest; together with large carnassial teeth in both upper and lower jaws, evince the carnivorous habits of the extinct species. Its marsupial nature is, in the author's opinion, demonstrated by the following cranial structures:—A large vacuity in the bony palate; a proportionally large lacrymal bone extending upon the face and perforated by the lacrymal canal, anterior and external to the orbit; three external precondyloid foramina; the perforation of the basisphenoid by the entocarotid canal; the great interval between the foramen ovale and foramen rotundum; the separation of the tympanic from the petrous bone; and the development of the 'bulla auditoria' in the alisphenoid; the position of the outlet for a vein from the lateral sinus behind and above the root of the zygoma; finally, the low and broad occiput, and the very small relative capacity of the brain-case.

In the marsupial order, the present large extinct Carnivore, for which the author proposes the name of '*Thylacoleo** *carnifex*,' is most nearly allied to the *Dasyurus* (*Sarcophilus*) *ursinus*; but is very different in its dentition from that and all existing Carnivora.

The fossils described were discovered by William Adeney, Esq., in a calcareous conglomerate stratum in a bank of a lake situated 80 miles south-west of Melbourne, Australia.

January 13, 1859.—Sir Benjamin C. Brodie, Bart., President, in the Chair.

"On the Embryology of *Comatula rosacea* (Linck)." By Prof. Wyville Thomson.

The author briefly described the male and female reproductive organs of *Comatula*. When the ova are mature, and before impregnation, they are protruded and remain hanging from the ovarian orifice, entangled in the areolar tissue of the everted ovary. In this position impregnation appears usually to take place.

After segmentation of the yelk, a solid nucleus is formed in the centre of the mulberry yelk-mass. This nucleus becomes invested in a special membrane; and into this embryonic mass the remainder of the yelk is gradually absorbed. Ciliary motion is observed at various points on the surface of the enclosed embryo, which finally assumes its characteristic form. The young larva, on escaping from the egg, consists of a homogeneous mass of pale-yellow granular matter, with scattered nuclei, cells, and oil-globules. It is barrel-shaped, and girded at intervals with about five broad ciliated bands.

As development proceeds, one of these belts becomes depressed at a certain point; and within the loop thus formed, an inversion of the integument indicates the position of the rudimentary mouth.

A distinct œsophagus and stomach are rapidly differentiated, and a short intestine, ending in a large anal orifice, near the posterior

* From θύλακος, *a pouch*; λέων, *a lion*.

extremity of the animal. The larva at the same time becomes lengthened and vermiform; the girding ciliated bands resolve themselves into a single transverse band, encircling the body near the anterior extremity, and a band passing below the mouth and longitudinally down either side to the tail.

Large lobulated masses of fine granular tissue occupy the cavity of the body on either side of the alimentary canal.

The echinoderm-zooid originates, apparently, beneath the integument of the larva, but perhaps in an inversion of that integument, in the form of a rosette of cells encysted near the upper extremity of the intestine. The rosette is at first single, but shortly takes the appearance of a double ring, the rings being united by a curved tube. These rings seem to represent the rudiments of the ambulacral vascular system of the echinoderm, and the curved tube the origin of the alimentary canal. A dense coating of granular areolar tissue is formed round the young crinoid, obscuring the further development of the internal organs. The mode of its disengagement from the larva was not observed.

Free from the locomotive larva, the echinoderm in its earliest stage is a motionless, white, egg-like body, covered externally with a thick transparent layer, which is traversed vertically by scattered fusiform oil-cells.

Beneath this layer are seen rapidly-forming patches of the calcified areolar tissue so characteristic of the class. The body becomes club-shaped; the narrow end attaches itself by cement-matter to some foreign substance, and a head and stem are distinguished.

Two corresponding rows of five plates each (the *basalia*, and the first row of the *interradialia*) form a calcareous chalice round the base of the head. Rudimentary arms now first make their appearance, and the development of the attached pentacrinal form proceeds steadily.

From his observations of several broods during the spring of 1858, the author was led to believe that, under circumstances favourable to the production of the pentacrinal stage, the development of the larva may be arrested in any of its earlier stages, and before the complete differentiation of its internal organs. It is hoped that the observations of another season may solve this and other questions which still remain somewhat obscure.

February 3, 1859.—Sir Benjamin C. Brodie, Bart., President, in the Chair.

"On the Aquiferous and Oviductal Systems in the Lamellibranchiate Mollusks." By George Rolleston, M.D., Lee's Reader in Anatomy, and Charles Robertson, Esq., Curator of the Museum, Christ Church, Oxford.

In this paper the authors bring forward two views as to the anatomy of the Lamellibranchiata.

1. The first part of the communication is devoted to an examination of the commonly-received opinion as to the outlet of the ovarian

system, and arguments are brought forward to show that the orifices usually supposed to discharge this office are in reality the exhalant orifices of a water-vascular system. The positive arguments drawn from the way in which fine injections thrown in by these orifices distribute themselves throughout the visceral mass, and from the relative position of orifices acknowledged to belong to a water-vascular system in other mollusks, are confirmed by a consideration of the improbability attaching to the old view, which regarded as oviducts in mollusca two canals, which lying one on either side of the body, yet communicate freely with each other at no great distance from their termination, and which lie far away from the lower segment of the intestinal tube. The inhalant aquiferous orifices are considered to be indicated by a belt of parasitic animals impacted in the foot tissue, as represented in one of the figures.

2. In the second part of the communication, the structures are indicated which the authors hold to be the true oviducts. One large band which is seen at the spawning season as a prominent ridge projecting into the calibre of the lower segment of the intestinal tube, and two smaller ones, which are traceable from the commencement of the intestine down to a point where its upper coils are in close proximity to that part of its lower segment where the former band ends in a club-shaped dilatation, are shown to discharge this function. The method of dissection to be adopted for the demonstration of these structures is given at some length, and the following arguments are adduced in support of the view which regards them as oviducts. A fine injection thrown into the largest of the bands in question is seen to pass into the ovary, and is recognizable under the microscope as contained within the limitary membrane of its ultimate follicles. Its distribution, therefore, as detectable at once by the naked eye and by the microscope, contrasts strongly with that of a similar injection thrown in by either of the aquiferous orifices. *Secondly*: The condition of distension, prominence, and intumescence of this band, coincides with similar conditions in the ovary; and from an acquaintance with the condition of the branchial marsupium's contents we are enabled always to predict what will be found to be that of this band. *Thirdly*: At periods when ova are being rapidly secreted by the ovary, ova are to be found at all points within the whole length of these three bands. The double oviduct at the oral and the single at the anal extremity of the Lamellibranchiata, is what our knowledge of their development would lead us to anticipate; and the close connexion of the principal oviduct with that latter outlet, and with the lower segment of the intestinal tube, brings the anatomy of these bivalve mollusks into exact correspondence with that of higher tribes in the same series.

What is said of the ovarian secretion and outlets, applies, *mutatis mutandis*, to the testicular.

February 24, 1859.—Sir Benjamin C. Brodie, Bart., President, in the Chair.

"On the Different Types in the Microscopic Structure of the Skeleton of Osseous Fishes." By A. Kölliker, Professor of Anatomy and Physiology in the University of Würzburg.

After having been occupied for several months with observations on the minute structure of the bones of fishes, I now take the liberty to present the results of my studies to the Royal Society.

The principal fact which I have to mention is, *that a great many genera of osseous fishes possess no bone-corpuscles, radiated or fusiform, in their skeleton, and therefore no real osseous tissue.* That there exist fish-bones without bone-corpuscles must have been long known in England to those who have collections of microscopic preparations of the hard tissues of animals, as Owen, Tomes, Williamson, Quekett, and others; but nobody seems to have mentioned the fact before Williamson, Quekett, Dr. Mettenheimer of Frankfort, and myself*. In the year 1850 Professor Williamson pointed out the absence of bone-corpuscles from the bones of the Cod, Haddock, Perch, Plaice, Pike, and various other fish, distinguishing them in this respect from the bones of the Eel, in which such corpuscles are abundant†; in 1853 I made known‡ that the bones of *Leptocephalus* and *Helmichthys* contain no trace of bone-corpuscles; a year later, Mettenheimer showed that the same was true of the bones of *Tetragonurus Cuvieri*§; and in 1855 Quekett mentions, in the second volume of the 'Histological Catalogue of the College of Surgeons of England,' fishes belonging to eighteen genera, in the bones of which he had not succeeded in finding bone-corpuscles—viz. *Vogmarus islandicus, Lophius piscatorius, Gadus morrhua, Ephippus, Sparus, Trigla cuculus, Belone vulgaris, Pleuronectes platessa, Trachinus vipera, Orthagoriscus mola, Exocœtus, Scarus, Esox, Sphyræna barracuda, Tetrapturus, Zeus faber, Perca fluviatilis, Gobio fluviatilis.* But, notwithstanding these most valuable observations, little or no progress seems to have been made in the more general treatment of this matter, as is best shown by the 'Comparative Histology' of Leydig (1857), in which (p. 157) the *Leptocephalidæ, Tetragonurus,* and *Orthagoriscus* are the only cases mentioned, in which the radiated bone-corpuscles are wanting.

On commencing a series of more extended investigations into the minute structure of fish-bones, in October last, I found that the genera which possess real osseous tissue are rather scarce, whilst,

* Since this communication was read to the Society, Dr. Sharpey has directed my attention to a statement by the late Professor J. Müller, to the effect that in the Pike and many other fish the bones are destitute of bone-corpuscles. This statement occurs in Müller's Annual Report of the progress of Anatomical and Physiological Science in 1835, and is repeated in his addition to the work of Miescher, "De Inflammatione Ossium, eorumque Anatome Generali," Berlin, 1836, p. 269.

† Phil. Trans. 1851, p. 693.

‡ Zeitschr. f. wiss. Zool. iv. p. 361.

§ Anat.-histol. Untersuch. ü. d. *Tetragonurus Cuvieri*, in den Abh. d. Senkenberg. Gesellschaft, i. p. 241.

on the other hand, I fell in with a great many types in which the bones contained no trace of lacunæ. And as this fact not only appeared to me of interest with regard to the development of the bones of fishes, but also promised to become of great value in systematic zoology, and in the determination of fossil remains, I devoted my whole time to this question. Now that I have investigated more than 200 species belonging to nearly all tribes of osseous fishes, and mounted about 500 microscopic preparations of their hard structures, I hope to be able to treat this question more comprehensively than has been possible hitherto, and in such a way as to lead to some general conclusions.

In giving the results of my observations, I begin with an enumeration of the fishes which belong to the one, and those which belong to the other type.

I. *Fishes whose bones contain no bone-corpuscles.*

Ordo I. Acanthopteri.

Fam. 1. *Percoidei.*

Perca fluviatilis.
Apogon Rex mullorum.
Pomatomus telescopium.
Lucioperca sandra.
Serranus cabrilla.
Anthias buphthalmus.
Acerina vulgaris.
Centrarchus sparoides.
Priacanthus macrophthalmus.
Therapon servus.
Trachinus vipera.
Trachinus draco.
Uranoscopus scaber.
Pomotis gibbosus.
Polynemus paradiseus.
Sphyræna spet.
Sphyræna barracuda.
Mullus barbatus.

Fam. 2. *Cataphracti.*

Trigla cuculus.
Trigla lyra.
Prionotus carolinus.
Platycephalus insidiator.
Dactyloptera volitans.
Cottus gobio.
Aspidophorus europæus.
Monocentris japonicus.
Gasterosteus trachurus.

Fam. 3. *Sparoidei* incl. *Mænides.*

Sargus annularis.
Sargus ovis.
Chrysophrys aurata.
Pagrus vulgaris.
Pagellus centrodontus.
Boops salpa.
Boops vulgaris.
Dentex vulgaris.
Smaris vulgaris.
Smaris insidiator.
Gerres Plumieri.

Fam. 4. *Sciænoidei.*

Corvina nigra.
Corvina lobata.
Micropogon undulatus.
Otolithus regalis.
Hæmulon formosum.
Pristipoma stridens.

Fam. 5. *Labyrinthiformes.*

Anabas scandens.
Helostoma Temminckii.
Ophicephalus striatus.
Trichopus trichopterus.
Polyacanthus Hasseltii.
Spirobranchus capensis.

Fam. 6. *Mugiloidei.*

Mugil cephalus.
Mugil, spec.
Atherina Humboldtii.
Atherina vulgaris.
Atherina macrophthalma.

Fam. 7. *Notacanthini.*

Mastacemblus pancalus.

Fam. 8. *Scomberoidei.*

Scomber scomber.
Xiphias gladius.
Tetrapturus belone.
Naucrates ductor.
Lampugus pelagicus.

Lampugus siculus.
Seriola, spec.
Chorinemus saltans.
Caranx trachurus.
Caranx carangus.
Centrolophus pompilus.
Lichia glauca.
Equula insidiatrix.
Argyreiosus vomer.
Vomer Brownii.
Zeus faber.
Capros aper.
Coryphæna hippurus.
Astrodermus guttatus.
Tetragonurus Cuvieri.

Fam. 9. *Squamipennes.*

Scatophagus argus.
Holacanthus, spec.
Toxotes jaculator.
Ephippus faber.

Fam. 10. *Tænioidei.*

Lepidopus argyreus.
Trichiurus haumela.
Trachypterus tænia.
Trachypterus repandus, *Costa.*
Trachypterus Spinolæ.
Cepola rubescens.

Fam. 11. *Gobioidei* et *Cyclopteri.*

Gobius capito.
Gobius cruentatus.
Gobius longiradiatus, *Risso.*
Amblyopus Hermannianus.
Eleotris humeralis.
Tripauchen vagina.
Anarrhichas lupus.
Lepadogaster Gouani.
Echineis remora.

Fam. 12. *Blennioidei.*

Blennius gattorugine.
Blennius Montagui.
Blennius galerita.
Salarias quadricornis.
Cristiceps, spec.
Clinus argenteus.
Callionymus lacerta.

Fam. 13. *Pedunculati.*

Lophius piscatorius.
Chironectes histrio.
Malthe vespertilio.
Batrachus tau.

Fam. 14. *Theutyes.*

Naseus longicornis.
Acanthurus nigricans.
Amphacanthus javus.

Fam. 15. *Fistulares.*

Fistularia tabaccaria.
Fistularia immaculata.
Centriscus scolopax.
Aulostoma sinense.
Amphisile scutata.

Ordo II. ANACANTHINI, *J. Müll.*

Fam. 1. *Gadoidei.*

Gadus æglefinus.
Gadus morrhua.
Lota vulgaris.
Motella tricirrhata.
Lepidoleprus trachyrhynchus.

Fam. 2. *Pleuronectides.*

Rhombus maximus.
Rhombus podas.
Platessa flesus.
Plaguria, spec.
Achirus mollis.

Fam. 3. *Ophidini.*

Ophidium barbatum.
Fierasfer imberbis.
Ammodytes tobianus.

Fam. 4. *Leptocephalidæ,* Bp.

Helmichthys punctatus.
Oxystomus hyalinus.
Leptocephalus pellucidus, *Bp.*
Hyoprorus messanensis, *Köll.*

Ordo III. PHARYNGOGNATHI, *J. Müll.*

Fam. 1. *Labroidei cycloidei.*

Labrus variegatus.
Labrus scrofa.
Julis vulgaris.
Julis pavo.
Crenilabrus pavo.
Xirichthys novacula.
Scarus creticus.

Fam. 2. *Labroidei ctenoidei.*

Pomacentrus fuscus.
Dascyllus araucanus.
Heliases castaneus.
Glyphisodon rhati.

Fam. 3. *Chromides.*

Chromis nilotica.
Chromis surinamensis.
Chromis, spec.
Cichla Deppii.

Fam. 4. *Scomberesoces.*

Belone vulgaris.
Belone caudimacula.
Tylosurus imperialis, *Bp.*
Sayris Camperi.
Hemirhamphus, spec.
Exocœtus exsiliens.

Ordo IV. Physostomi, *J. Müll.*

Fam. 1. *Siluroidei.*

Subfam. *Eremophilini*, Bp.
Trichomycterus punctulatus.

Fam. 4. *Cyprinodontes.*

Pœcilia vivipara.
Anableps tetrophthalmus.
Cyprinodon calaritanus.
Molienesia latipinnis.
Orestias tæniatus.
Fundulus nigrescens.

Fam. 6. *Esoces.*

Esox vulgaris.
Umbra Krameri.

Fam. 7. *Galaxiæ.*

Galaxias truttaceus.

Fam. 9. *Scopelini.*

Saurus lacerta.
Myctophum elongatum, *Bp.*
Ichthyococcus Poweriæ, *Bp.*
Gonostoma denudata, *Raf.*
Argyropelecus hemigymnus, *Cocco.*
Odontostoma Balbo.

Fam. 10. *Chauliodontidæ*, Bp.

Chauliodus setinotus, *Schn.*
Stomias barbatus, *Risso.*

Fam. 12. *Heteropygii.*

Amblyopsis spelæus.

Fam. 15. *Symbranchii.*

Symbranchus marmoratus.
Symbranchus immaculatus.
Amphipnous cuchia.
Monopterus javanicus.

Ordo V. Plectognathi.

Fam. 1. *Balistini.*

Balistes capriscus.
Monacanthus geographicus.
Aluteres lævis.
Triacanthus brevirostris.

Fam. 2. *Ostraciontes.*

Ostracion triqueter.

Fam. 3. *Gymnodontes.*

Diodon, spec.
Tetraodon fahaca.
Tetraodon lineatus.
Orthagoriscus mola.

Ordo VI. Lophobranchii.

Syngnathus typhle.
Hippocampus guttulatus.
Pegasus draco.

II. *Fishes whose bones contain bone-corpuscles.*

Subclassis I. Teleostei, *J. Müll.*

Ordo I. Acanthopteri.

Fam. 8. *Scomberoidei.*

Thynnus vulgaris.
Thynnus alalonga.
Auxis bisus.

Ordo IV. Physostomi.

Fam. 1. *Siluroidei.*

Silurus glanis.
Silurus bicirrhis.
Schilbe mystus.
Synodontis serratus.
Malapterurus electricus.
Malapterurus beninensis.
Heterobranchus anguillaris.
Chaca lophioides.
Plotosus unicolor.
Clarias fuscus.
Pimelodus, spec.
Arius, spec.
Bagrus, spec.
Callichthys, spec.
Loricaria cataphracta.
Auchenipterus furcatus.
Heteropneustes fossilis.
Aspredo lævis.

Fam. 2. *Cyprinoidei.*

Phoxinus lævis.
Cobitis barbatula.
Aspius bipunctatus.
Alburnus lucidus.
Gobio fluviatilis.
Rhodius amarus.
Cyprinus carpio.
Abramis blicca.

Leuciscus rutilus.
Leuciscus tincella.
Tinca chrysitis.
Barbus vulgaris.
Barbus elongatus.
Barbus obtusirostris.
Barbus marginatus.
Chondrostoma risella, *Ag.*
Dangila lipocheila.
Labeo niloticus.
Catostomus, spec.

Fam. 3. *Characini.*

Citharinus Geoffroyi.
Distichodus niloticus.
Hydrocyon Forskahlii.
Alestes dentex.
Tetragonopterus mexicanus.
Anodus cyprinoides.
Leporinus, spec.
Pacu tæniurus.
Pacu nigricans.
Erythrinus unitæniatus.
Macrodon trahira.
Piabuca bimaculata.
Gasteropelecus sternicla.
Chirodon, *Girard,* n. spec.
Brycon, *Müll. Tr.,* n. spec.

Fam. 5. *Mormyri.*

Mormyrus bane.
Mormyrops anguilloides.
Mormyrus longipinnis.
Mormyrus oxyrhynchus.
Mormyrus cyprinoides.
Mormyrus, spec.

Fam. 8. *Salmones.*

Salmo salar.
Salmo trutta.
Argentina silur.

Fam. 11. *Clupeini.*

Clupea harengus.
Alosa vulgaris.
Alosa melanura.
Coilia Grayi.
Engraulis encrasicholus.
Engraulis Brownii.
Notopterus Pallasii.
Macrostoma angustidens, *Risso.*
Meletta thryssa.
Elops saurus.
Megalops cyprinoides.
Chatoessus cepedianus.
Chatoessus punctatus.
Gnathobolus mucronatus.
Chirocentrus dorab.
Pristigaster, spec.
Lutodeira chanos.
Butirinus macrocephalus.
Hyodon claudulus.
Heterotis niloticus.
Osteoglossum Vandellii.
Osteoglossum formosum.
Sudis gigas.
Alepocephalus rostratus.

Fam. 13. *Murænoidei.*

Anguilla vulgaris.
Conger myrus.
Ophisurus serpens.
Nettastoma melanura.
Sphagebranchus imberbis.

Fam. 14. *Gymnotini.*

Gymnotus electricus.
Carapus brachyurus.

Subclassis II. **Ganoidei.**

Ordo I. HOLOSTEI.

Fam. 1. *Lepidosteini.*

Lepidosteus platyrhynchus.

Fam. 2. *Polypterini.*

Polypterus bichir.

Fam. 3. *Amiidæ.*

Amia calva.

Ordo II. CHONDROSTEI.

Fam. 1. *Acipenserini.*

Acipenser nacarii.
Scaphyrhynchus Rafinesquii.

Fam. 2. *Spatulariæ.*

Spatularia folium.

Subclassis III. **Dipnoi.**

Fam. 1. *Sirenoidei.*

Lepidosiren annectens.

From these facts it follows that the osseous fishes, notwithstanding their great number, are separated in a very remarkable way into two groups, as shown in the following enumeration:—

Fishes with bone-corpuscles.	*Fishes without bone-corpuscles.*
I. All the extensive and higher-organized tribes of *Physostomi*, J. Müll.; viz. the Siluroidei (except *Trichomycterus*). Cyprinoidei. Characini. Mormyri. Salmones. Clupeini. Murænoidei. Gymnotini.	I. All the numerous tribes of the *Acanthopteri*, with the exception of the genus *Thynnus*.
II. All the *Ganoidei*.	II. All the *Anacanthini*, J. Müll.
III. The *Sirenoidei*.	III. The *Pharyngognathi*, J. Müll.
IV. Of the *Acanthopteri*, only the genus *Thynnus*, Cuv.	IV. Some smaller and lower-organized tribes of *Physostomi*, as the Cyprinodontes. * Esoces. Galaxiæ. Scopelini. Chauliodontida, *Bp*. Heteropygii. Symbranchii. And of the Siluroids, only the genus *Trichomycterus*.
	V. The *Plectognathi*.
	VI. The *Lophobranchii*.

As there can be no doubt that most of the higher-organized fishes are amongst those with bone-corpuscles, and as we know that amongst the higher vertebrata, even the lowest, viz. the Perennibranchiata, possess real osseous tissue, it seems to follow that the peculiar distribution of real osseous tissue and of the "osteoid" structure, as the osseous tissue without corpuscles may be called, has a deeper signification. This will be found by studying the development of the bones in both groups; and I hope to be able, before long, to present to the Royal Society some new facts with regard to this matter also; but in the mean time, until my observations are more complete, I must abstain from further explanation.

The facts exposed hitherto have had reference only to a great and fundamental structural difference between two extensive groups of osseous fishes. I may now add, that there exist also greater or lesser structural discrepancies amongst the different tribes of each group. But as this is not a suitable occasion for an exposition of the details of this question, I will only say this much:—In the higher fishes, those with real osseous tissue, there exist differences, especially with regard to the *form* and *size* of the bone-corpuscles; and I hope to be able to show that there are peculiar and tolerably well characterized types of them amongst the Ganoids, Siluroids, *Salmonidæ*, Cyprinoids, *Clupeini*, &c. In the second group there are more varieties. In some tribes the bones are quite structureless homogeneous masses, as in the *Leptocephalidæ*; in others they have a peculiar fibrous appearance, and consist of a singular mixture of cartilage and osteoid structures, as Quekett first showed in the genera *Orthagoriscus* and *Lophius*, to which I may add some *Balistini*; but in the great majority of the tribes of this group, the bones contain peculiar *tubes* more or less similar to those of dentine. If these tubes are well developed, the bones acquire a structure *which can in no way be distinguished from that of dentine*,—a fact, which also did not escape the perspicacity of Quekett, who mentions its occurrence in the genus *Fistularia*, the Barracuda Pike (*Sphyræna barracuda*), and the Gar-fish (*Belone vulgaris*). I found the same structure in many other genera of this group, especially among the *Plectognathi*, *Pharyngognathi*, *Sparidæ*, and *Squamipennes*; but in the greater number this tubular structure is not so well developed, and is intermingled with more structureless parts. Another fact deserving of mention with regard to the bones of this group is, that there very frequently occur also structures, formed by the agglomeration of calcareous globules of different sizes, which resemble in a remarkable degree the lower layers of common fish-scales.

My observations have also extended to the *hard structures of the skin* of fishes, and of *the rays of the fins*; and I may say that in general the same laws, which apply to the structure of the endoskeleton, hold good also for the exoskeleton. Evidence of this is especially afforded by the fins, the rays of which, independently of their hard or soft condition, contain bone-corpuscles in all the tribes where the internal bones are provided with them, whilst in the other case these rays are formed of a homogeneous osteoid substance or of a tubular structure, which may also in some fishes, as Williamson first showed in the Ostracionts, assume the structure of real dentine, as in many Plectognaths (*Triacanthus*, *Monacanthus*, *Aluteres*, *Tetraodon*, and others), and in certain *Acanthopterygii* (*Equula*, *Ephippus*, *Hæmulon*, *Pristipoma*, *Scatophagus*, *Centrarchus*). With regard to the skin, we may at least go so far as to say that in no fish whose endoskeleton is destitute of bone-corpuscles do they exist in the hard structures of the skin; but, on the other hand, the tribes which have real osseous tissue do not all present it also in the skin. Scales or plates with bone-corpuscles are found amongst living Ganoids, *e. g.* in *Polypterus*, *Lepidosteus*, and even *Amia* (in whose scales J. Müller erroneously supposed them to be wanting), and also in the *Acipenserini* and *Spatulariæ*; they exist also in the fossil Ganoids, as the excellent observations of Williamson have shown.

In many Ganoids, moreover, as Williamson and Quekett have shown, the scales often contain dentinal tubes, or even portions of real dentine ("Kosmine" of Williamson) amidst true bone. In the scales of *Lepidosiren*, also, I find bone-corpuscles, but mostly fusiform, and only here and there having a simple stellate figure. Of the other fishes which have bone-corpuscles in their skeleton, little has hitherto been noted as to the coexistence of such corpuscles in their scales, but I find it to prevail to a considerable extent among them. The presence of bone-corpuscles has been long known, it is true, in the larger scales of the "corselet" of *Thynnus*, also in the dermal plates of certain Siluroids (*Loricaria* and *Callichthys*), and was pointed out by J. Müller in the scales of *Sudis*. Leydig, too, states that true bone-corpuscles exist in the walls of the grooves and semicanals upon the scales of the lateral line in certain Cyprinoids (Carp, Tench, and Barbel). This statement I am able fully to confirm, and to add the following genera in which I find the same thing to occur; viz.—*Hydrocyon*, *Alepocephalus*, *Macrostoma*, Risso, *Piabuca*, *Serrasalmo*, *Xiphorhamphus*, *Tetragonurus*, *Salminus*, *Chalcinus*, *Pygocentrus*, *Labeo*, and *Catostomus*. But, besides the instance of *Sudis* and certain Siluroids above referred to, I find that many other *Physostomi* have true bone-corpuscles in their scales; not only those of the lateral line, but all of them. From the results of my examinations up to this time, which, however, on account of the want of materials, are by no means complete, I am able to make out the following list:—

1. Characini.

Of this family I have had the means of examining nearly all the genera, including forty-one species.

Characini with bone-corpuscles in all their scales.

Erythrinus unitæniatus, *Spix*.
Erythrinus microcephalus, *Agass*.
Macrodon trahira, *J. Müll.*
Macrodon auritus, *Val.*
Pacu tæniurus (Prochilodus tæniurus, *Val.*).
Pacu nigricans, *Spix*.
Pacu lineatus, *Val.*
Distichodus niloticus, *Müll. Tr.*
Alestes dentex, *Müll. Tr.*
Anodus cyprinoides, *Müll. Tr.*
Anodus edentulus, *Agass.*
Anodus leucos, *de Fil.*
Schizodon fasciatus, *Agass.*
Chilodus punctatus, *Müll. Tr.*
Rhaphiodon (Cynodon) vulpinus, *Agass.*
Leporinus fasciatus, *Müll. Tr.*
Leporinus elongatus, *Val.*
Citharinus latus, *Ehr.*

Characini without bone-corpuscles in their scales.

*Hydrocion Forskahlii, *Cuv.*
*Piabuca bimaculata (*Hyrtl. misit*).
Gasteropelecus sternicla, *Bl.*
Gasteropelecus securis, *de Fil.*
Cheirodon Girard, nov. sp., *de Fil.*
Brycon falcatus, *Müll. Tr.*
Brycon, nov. sp., *de Fil.*
Serrasalmo rhombeus, *Cuv.*
*Serrasalmo marginatus, *Val.*
Xiphorhamphus falcatus, *Müll. Tr.*
*Xiphorhamphus hepsetus, *Müll. Tr.*
Myletes rubripinnis, *Müll. Tr.*
Myletes rhomboidalis, *Cuv.*
Tetragonurus mexicanus, *de Fil.*
*Tetragonurus argenteus, *Art.*
*Tetragonurus maculatus, *Müll. Tr.*
*Salminus Orbignyanus, *Val.*
*Chalcinus Mülleri, *de Fil.*
Pygocentrus nigricans, *Müll. Tr.*
Epicyrtus gibbosus, *Müll. Tr.*
Piabucina erythrinoides, *Val.*
Exodon paradoxus, *Müll. Tr.*
Leporinus, spec.

With regard to the members of the second division, it is to be observed, that probably in all of them the canals attached to the scales of the lateral line are formed of true osseous tissue; in those marked with an asterisk I have found this by actual examination.

The *Characini* are thus divisible into two groups, according to the nature of their scales; at the same time, these are not to be regarded as natural divisions in other respects, and the less so as one and the same genus, such as *Leporinus*, for example, may include species which differ in the composition of their scales. The presence of corpuscles, though connected partly with the size of the scales, does not depend solely on this, for they may be wanting in large scales

(*Hydrocyon, Chalcinus, Salminus*), and present in small ones (*Anodus edentulus, Chilodus*).

2. Mormyri.

Mormyrus longipennis, *Rüpp.*
Mormyrus oxyrhynchus.
Mormyrus bane.
Mormyrus cyprinoides.
Mormyrus, spec.
Mormyrops anguillaris.

3. Clupeini.

Megalops cyprinoides.
Elops saurus.
Coilia Grayi.
Notopterus Pallasii (corpusc. very scanty).
Butirinus macrocephalus.
Hyodon claudulus.
Osteoglossum Vandelii.
Osteoglossum bicirrosum.
Heterotis niloticus.

The plates of the abdominal carina in many *Clupeini* are formed throughout of true bone, but do not belong to the present category.

I am unable to find corpuscles in the scales of *Lutodeira chanos, Chatoessus punctatus* and *cepedianus*, and *Alosa vulgaris*. In several Cyprinoids (*Labeo, Catastomus, Barbus*), I have, in like manner, failed to discover corpuscles in the scales proper; on the other hand, I have found very distinct dentinal tubes in the scales of *Barbus*, at their hinder part.

True osseous tissue will doubtless hereafter be found in the scales of many other *Physostomi* which have it in their skeleton, but it is not to be supposed that this will apply to all.

In the *Physostomi*, as in the Ganoids, the bone-corpuscles lie in the lower stratum of the scale; still they are situated above the fibrous layer, and immediately beneath the structureless layer, to which in all scales I apply the name of "ganoin-layer," inasmuch as it has in all cases the same signification.

From the foregoing observations we are able to show still more positively than could be done by J. Müller, that the scales of Ganoids have no peculiarity of structure to distinguish them from those of the *Teleostei*. Nay, certain Ganoids, as *Amia*, have scales, which in respect even of pliancy, rounded contour, and the surface-marking of the ganoin-layer, agree with those of other fishes.

In reference to those fishes which want bone-corpuscles in their skeleton, I have still to remark,—1, that the corpuscles are also invariably wanting in the semicanals upon the scales of the lateral line; for what Leydig designates as rudimentary bone-corpuscles in the Perch are in fact the tubules of the osteoid substance; 2, that amongst the group of fishes in question, there are some which have beautiful dentine in their skin-bones, *e. g. Amphisile scutata* and the Ostracionts.

To the foregoing remarks on the microscopic structure of the hard tissues of fishes, I may add, that there also exists a third group of fishes, in which the endoskeleton is composed only of common cartilage, or of cartilage with depositions of earthy salts, viz. the *Cyclostomi* and *Selachii*. None of these fishes, not even the *Plagiostomi* and *Chimæra*, possess real bone-cells in their hard parts; for these are formed only, as J. Müller showed many years ago, by ossified cartilage, that is to say, cartilage-cells in an ossified matrix. Even the hard spines of the fins and of the skin of these animals are not real bone, but dentine, as was demonstrated long since by Agassiz and Quekett.

If now we sum up all that has been said, we arrive at the following conclusions:—

I. There exist *three types* of structure in the skeleton of fishes, viz.:

1. *Type of the Selachii.*
The skeleton is formed of cartilage or ossified cartilage.
Selachii, Cyclostomi.

2. *Type of the Acanthopterygii.*
The skeleton is formed of a homogeneous or tubular osteoid substance, often of true dentine.
Teleostei (*J. Müll.*), with the exception of the greater part of the Physostomi (*J. Müll.*).

3. *Type of the Ganoidei.*
The skeleton is formed of real osseous tissue.
Most of the Physostomi, the Ganoidei, and Sirenoidei.

II. The *exoskeleton* follows in some respects the same laws as the endoskeleton, and shows the following types:—

1. *Exoskeleton formed of a homogeneous and fibrous osteoid substance.*
Scales of the majority of the Teleostei.

2. *Exoskeleton formed of dentine.*
Spines of Selachii and scales of Plectognathi, and of *Amphisile*, in part.

3. *Exoskeleton formed of real bone*; partly in association with homogeneous osteoid substance (*ganoin*) and dentinal tubes.
Scales of Ganoidei, of *Lepidosiren*, some Siluroidei, of Mormyri, many Characini and Clupeini, also of *Thynnus*.

In terminating this communication, I think it proper to mention that the great liberality with which my friend Mr. Tomes of London, and Professor Williamson of Manchester, put their large collections of microscopic preparations of teeth, bones, and scales at my disposal, proved of great assistance in my investigations, and, accordingly, I am only fulfilling an agreeable duty in now publicly expressing my obligations to them. I am also greatly indebted to my friends Filippo de Filippi of Turin and Henry Müller of Würzburg, also to Dr. Hyrtl of Vienna, and Dr. Peters of Berlin, who supplied me with many of the rarer Mediterranean and foreign fishes. But, in order that my observations may yield the results which may not unreasonably be expected from them, I need more aid; and as England is the country in which not only the largest zoological collections of fishes, but also the greatest number of microscopic preparations of the hard tissues of recent and fossil animals, are to be found, I take the liberty to ask the possessors of such collections who may be interested in this matter to favour me with such specimens as may seem to them calculated to give to this series of observations the greatest possible extension.

GEOLOGICAL SOCIETY.

April 20, 1859.—Major-General Portlock, V.P., in the Chair.

"On some Reptilian Remains from South Africa." By Prof. Owen, F.R.S., F.G.S.

Fam. Crocodilia. *Galesaurus planiceps*, the Flat-headed Galesaur (from γαλῆ, polecat, σαῦρος, lizard), a genus and species founded on an entire cranium and lower jaw. The skull in length less than twice the breadth, much depressed, and flat above. Occipital region sloping from above backward, divided by a high and sharp ridge from the temporal fossæ; these are wide and rhomboidal; orbits small; nostril single and terminal. Dentition, $i. \frac{4-4}{3-3}$, $c. \frac{1-1}{1-1}$, $m. \frac{11-11}{12-12}$; all the teeth close-set, except the intervals for the crowns of the long canines when the mouth is closed. Canines of the shape and proportions of those in *Mustela* and *Viverra*, without trace of preparation of successors in the sockets; of quite mammalian character. Incisors longish and slender, molars subcompressed; both with simple pointed crowns, of equal length, and undivided roots. Original transmitted to the British Museum by Governor Sir George Grey, K.C.B. From the sandstone rocks, Rhenosterberg.

Cynochampsa laniarius, the Dog-toothed Gavial (from κύων, dog, and χάμψαι, Egyptian name for Crocodiles, applied by Wagner to the Indian Gavial). This genus and species is founded on the rostral end of the upper and lower jaws of a Crocodilian Reptile, with a single terminal nostril, situated and shaped as in *Teleosaurus*, and indicating similarly long and slender jaws. Only the incisive and canine parts of the dentition are preserved; but these closely correspond with the same parts in *Galesaurus*, the incisors being equal and close-set, of simple conical form, and the canines suddenly contrasted by their large size. In shape they resemble closely the completely formed canines in Carnivorous Mammals. There is no trace of successional teeth. Original transmitted to the British Museum by Governor Sir George Grey, K.C.B., from Rhenosterberg, South Africa.

Fam. Dicynodontia. Subgenus *Ptychognathus*, Ow. (πτυχὸς, ridge, γνάθος, jaw).—This subgenus is founded on four more or less entire skulls, two retaining the lower jaw, referable to two species.

Ptychognathus declivis, Ow.—Plane of occiput meeting the upper (fronto-parietal) plane at an acute angle, rising from below upward and backward, as in the feline mammals; fronto-parietal plane bounded by an anterior ridge, extending from one superorbital process to the other; from this ridge the facial part of the skull slopes downward in a straight line, slightly diverging from the parallel of the occipital plane; superoccipital ridge much pro-